National Overview of the Municipal Separate Storm Sewer System (MS4) Program: Status and Progress

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ABSTRACT

In fall 2010, the Environmental Protection Agency (EPA) sent information collection request (ICR) questionnaires to more than 600 regulated municipal separate storm sewer systems (MS4s) to help EPA collect information on MS4 program implementation. This ICR represents a comprehensive national data collection on implementation of the MS4 program. A total of 471 regulated MS4s responded to the questionnaires. This paper summarizes the MS4 ICR data, and discusses the results with key differences between Phase I (medium and large) MS4s and Phase II (small) MS4s. The ICR questionnaires primarily focused on post-construction standards and programs in order to collect data to support a potential EPA rulemaking that would address stormwater discharges from newly developed and redeveloped sites. The ICR also asked for information about other aspects of the MS4 program, including public education and involvement, illicit discharges, good housekeeping, retrofits, industrial sources and monitoring. The questionnaires results generally found a high level of implementation in many of the MS4 program areas.

KEYWORDS

Stormwater, MS4, Municipal Separate Storm Sewer System, Questionnaire, Information Collection Request

INTRODUCTION

To address water quality problems from stormwater discharges, Congress, in 1987, amended the Clean Water Act to add Section 402(p) that established a phased approach to regulating discharges of stormwater, including large and medium municipal separate sewer systems (MS4s). EPA issued stormwater regulations in 1990, called “Phase I” (40 CFR 122.26(d)(2)(ii) and (iv)(C)). These 1990 regulations require medium and large MS4s with populations of 100,000 or more to obtain National Pollutant Discharge Elimination System (NPDES) permit coverage for their stormwater discharges. These

regulations also covered certain industrial discharges including large construction sites. The Clean Water Act amendments in 1987 also required EPA conduct studies on other stormwater discharges, with the goal of identifying other sources contributing to water quality degradation and to provide a basis for establishing a comprehensive program to regulate such sources. These studies eventually led to "Phase II" of the stormwater regulations, issued in 1999, which requires small MS4s in urbanized areas and small construction sites to obtain NPDES permit coverage for their stormwater discharges.

Each regulated MS4 is required to develop and implement a stormwater management program (SWMP) to reduce the contamination of stormwater runoff and prohibit illicit discharges.

The SWMP requirements for Phase I are:
- Demonstration of adequate legal authority
- Fiscal resources analysis
- Source identification and monitoring
- Post-construction controls
- Good housekeeping
- Illicit discharge detection & elimination w/ public education
- Industrial & construction coverage

The SWMP requirements for Phase II are very similar and described as six minimum control measures:
- Public education & outreach
- Public participation
- Construction site controls
- Illicit discharge detection & elimination
- Post-construction controls
- Pollution Prevention/good housekeeping

MS4 discharges are regulated by permits issued by state permitting authorities or EPA. Phase I MS4s are primarily issued individual permits, while Phase II MS4s are primarily covered under general statewide permits.

In 2008, the National Research Council (NRC) released a report that made a number of findings and recommendations to improve the stormwater program. The NRC report found that: 1) the current regulatory approach does not adequately control all sources of stormwater discharges that contribute to waterbody impairment, and 2) despite the achievements of EPA's stormwater program, stormwater discharges remain one of the greatest challenges in water pollution control.

In December 2009, EPA issued a Federal Register Notice seeking stakeholder input to help EPA shape a program to reduce stormwater impacts (74 FRN 68617, December 28, 2009). This notice began the process for EPA to consider regulatory changes to reduce stormwater discharges from newly developed and redeveloped sites and make other regulatory improvements to strengthen the stormwater program.

In the fall of 2010, EPA sent out a stormwater Information Collection Request (ICR) to gather information and collect baseline information for the stormwater rulemaking, (copies of the ICR questionnaires are available at www.epa.gov/npdes/stormwater/rulemaking). EPA sent separate ICR questionnaires to three different types of MS4s:

- Regulated MS4s (the medium and large MS4s covered under Phase I, and the small MS4s covered under Phase II)

- Non-Regulated MS4s (MS4s that are not currently regulated under Phase I or Phase II)
- Transportation MS4s (Phase I or Phase II MS4s that are a transportation entities)

There are approximately 750 Phase I MS4s and 6,600 Phase II MS4s currently permitted. EPA distributed the MS4 questionnaires to a statistically-sampled subset of these facilities, sending it to 608 regulated MS4s, 84 regulated Department of Transportation MS4s and 932 non-regulated MS4s. EPA received responses from 471 regulated MS4s, 84 regulated DOT MS4s, and 294 non-regulated MS4s.

EPA also sent a questionnaire to each of the NPDES permitting authorities (generally the state environmental agency).

Responses to the questionnaires are being used by EPA to assess current stormwater practices and requirements and characterize costs associated with controlling stormwater discharges.

This questionnaire was the first time that EPA had collected national data on MS4 program implementation from regulated MS4s. This paper summarizes and discusses the data collected in Part A of the questionnaire, which includes technical and programmatic data about municipal stormwater programs. EPA is still reviewing data from Part B, which includes financial and cost data from the MS4s.

GENERAL DESCRIPTION OF MS4S

Out of the 471 regulated MS4 questionnaires EPA received, 249 were Phase I MS4s (53%) and 222 were Phase II MS4s (47%).

Permit Types and Number of Permits

MS4s are typically subject to only one type of MS4 permit—either Phase I or Phase II. Only a few respondents indicated that they are subject to more than one MS4 permit (these are generally either large counties that are part of a Phase I MS4 permit program and also have a separate urbanized area that is subject to Phase II, or State DOTs that are subject to multiple MS4 permits across the state).

The majority of Phase I MS4s are covered under an individual permit (69%) while the majority of Phase II MS4s (80%) are covered under a general permit. NPDES permits are issued for up to five-year permit terms.

Some of the first Phase I MS4 permits were issued in the early 1990s and have been reissued several times; 23% of Phase I MS4s are currently covered under their fourth MS4 permit. Phase II MS4 permits were first issued in 2003, but most Phase II MS4s are still covered by their first permit (45%) or second permit (44%) (Figure 1).

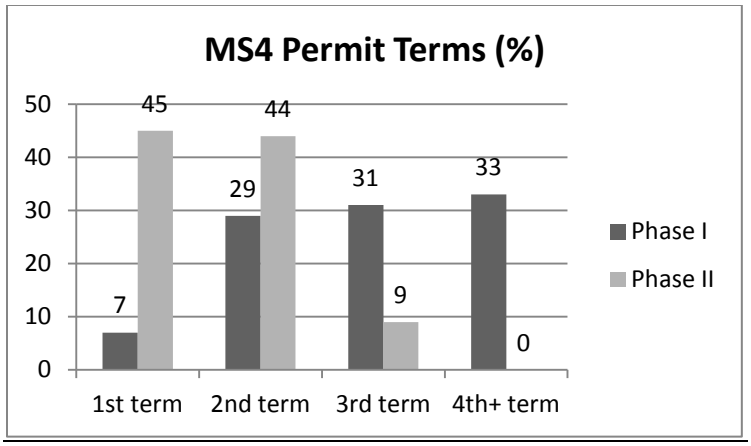

Figure 1. MS4 permit terms

Geographical Boundaries of MS4 Permits

Under the Phase II program, the regulated permitted area, at minimum, is defined as the urbanized area boundary as set by the Census, therefore, the MS4 permitted area could cover only a portion of the city or county. However, only twenty-eight percent of Phase II MS4s indicated that their MS4 permitted area was based on urbanized area. For a majority of Phase I MS4s (74%) and Phase II MS4s (61%), the geographical extent of their MS4 permitted area is the jurisdictional boundary.

In many cases the MS4's entire jurisdictions is located within an urbanized area (65%). In addition, many states permit the entire jurisdiction for Phase II if a portion of the jurisdiction is urbanized. EPA confirmed that fourteen states require the entire city to be covered under Phase II if only a portion of the city is in the urbanized area (these states include NJ, NY, KY, NC, IN, WI, MN, IA, MO, CO, ND, SD, OR and WA). In cases, in which the MS4 regulated area is less than the jurisdictional area, many MS4s (30-40%) indicated that they implement their stormwater program activities to the entire jurisdiction including public education, IDDE, street sweeping, and post-construction controls.

Population Size

The populations of MS4s vary greatly in size. Based on the 2010 Census, the average Phase I MS4 has a population of 115,000 and the average Phase II MS4 has a population of approximately 20,000. From the ICR questionnaire, the range of populations of MS4 respondents was under 1,000 people to more than one million people, with the median population about 50,000.

POST-CONSTRUCTION PROGRAMS

As many states have improved their program to reduce stormwater discharges from new development and redevelopment, EPA has been gathering specific data on the elements of the post-construction stormwater program. These elements include:

- Post-construction standard
- Drivers and incentives
- Plan review and legal authority
- Maintenance and inspections

Post-construction Standard

MS4s are required to develop a program to control stormwater discharges from new development and redevelopment that disturb at least one acre or less than one acre if the project is part of greater plan of development. The ICR questionnaire found that most states require new development or redevelopment projects within the MS4 service area to implement either a numeric or specific post-construction performance standard or meet design criteria for stormwater controls (80% of Phase I and 64% of Phase II). In addition, most Phase I MS4s (65%) and Phase II MS4s (55%) indicated that they have the same standard for new development and redevelopment. Therefore, in most cases the expectation for stormwater management is the same regardless of whether it is new development or redevelopment. Furthermore, 61% of all respondents apply their post-construction program to all types of new development including residential, commercial, industrial, institutional and mixed use. The respondents also indicated that post-construction performance measures are determined by a number of factors, including local, state and EPA requirements (Table 1).

Table 1. Question: Who determined your MS4's stormwater performance standard or design criteria for post-construction controls for new or redevelopment activities?

	Phase I	Phase II
The state (or EPA if they are the NPDES permitting authority in your state) enacted these requirements that are implemented through the MS4 permit	43%	28%
The state enacted these requirements that are implemented through the state construction stormwater permit	14%	18%
The state enacted these requirements that are implemented through the state stormwater permit	15%	11%
The county enacted these regulations that the MS4 is required to implement	15%	12%
The requirement was enacted by a local governmental body	37%	30%
Other	9%	7%

There were different types of performance standards reported including match pre- and post-development hydrology peak discharge rate for a specified storm (1-year storm to 100-year storm), detention of a specified storm, retention of a specified storm, pollutant reduction requirement, channel protection measure, groundwater recharge requirement, limits on impervious cover, and other types. In addition to the questionnaire, EPA has compiled a list of current state post-construction standards[1]. Twenty-one states have a narrative post-construction requirement. Thirty states have a numeric performance standard to retain or treat discharges from new and redevelopment. Eighteen of those states have specific retention standards to infiltrate, evapotranspire, or harvest and use the water quality volume with the remaining thirteen states having a treatment standard.

Most states require the post-construction standard to be met for development projects within the regulated MS4. However, ten states apply their standard statewide and two states apply their standard to certain regions of the state (MA – wetland areas; NC – coastal counties).

EPA regulations require the post-construction program to be applied to all sites in MS4s disturbing at least one acre. However, eight states apply their standards to sites less than one acre:

[1] http://cfpub.epa.gov/npdes/stormwater/rulemaking/performancestandards.cfm

- MA – no size threshold for sites within a wetland area
- VT – 1 acre developed or an increase in impervious cover statewide
- NJ – 1 acre of disturbed area or an increase in impervious cover by ≥ 0.25 acres statewide
- DE, MD – 5,000 sq ft of disturbed area statewide
- FL – 4,000 sq ft of impervious area statewide
- NC – 10,000 sq ft for nonresidential site in coastal area and residential site within ½ mile of shellfish water
- WA – 2,000 sq ft of new or replaced impervious cover or 7,000 ft of disturbed area in regulated MS4s

There is some variability in how MS4s define new development and redevelopment. Most MS4s (85%) consider infill projects on existing undeveloped parcels to be new development. For the replacement of impervious surfaces (e.g., road resurfacing), 37% of MS4s considered this to be redevelopment and subject to the standard, while 52% of MS4s did not apply the standard to this type of activity. Roadway widening was classified as new development in 38% of the Phase I MS4s and as redevelopment by 33% Phase I MS4s but about half of the Phase II MS4s classified these projects as new development (47% as new development and 25% as redevelopment).

The questionnaire asked whether the post-construction standard is required to be met through mandatory on-site stormwater management, or is a combination of on-site and community/neighborhood or regional management allowed. Over half of the MS4s (58%) reported that the standard must be met on-site, while 34% allow the standard to also be met at the community/neighborhood scale, 27% allow it to be met at the regional scale and 9% reported other.

For both Phase I and II programs, about 50% of MS4s reported that they offer alternatives to compliance with the performance standard. There are several types of alternatives to compliance if the standard cannot be met, such as a waiver or appeal process, or by allowing mitigation or payment in lieu (Table 2). There were no significant differences in the answers for alternatives to compliance between new development and redevelopment projects.

Table 2. Alternatives to compliance

	Phase I	**Phase II**
Waiver process	23%	14%
Appeal process	14%	7%
Stormwater mitigation	10%	2%
Payment in lieu	11%	2%
Alternative compliance program	10%	3%
Other level of government offers	4%	2%
Alternative compliance program does not exist	32%	43%

For MS4s that do offer an alternative compliance to the performance standard, it is based on several factors (Table 3). The MS4 operator staff is primarily responsible for determining compliance feasibility (22%).

Table 3. Basis for allowing alternatives to compliance

	Phase I	Phase II
Infiltration cannot be achieved: lot size too small outside of the footprint to create the necessary infiltration capacity (even with amended soils), shallow groundwater or other infiltration issues	22%	10%
Soil instability as documented by geotechnical analysis	17%	7%
Capture or reuse of stormwater cannot be achieved on the property	16%	7%
Cost constraints	8%	2%
Other	28%	14%
An alternative compliance program does not exist	39%	43%

Plan Review, Tracking, Maintenance, Inspections and Enforcement

MS4 reported that the enforcement mechanisms they use to ensure that post-construction standards are met include: site inspections during (67% for all MS4s) and after construction (57%) as well as plan review, approval and acceptance (71%). Few MS4 programs reported review of self-reporting and self-certification (17%) databases as an enforcement mechanism.

EPA regulations require MS4s to ensure long-term operation and maintenance of post-construction controls, but are given flexibility in how maintenance is ensured. The tracking, inspection, and maintenance of stormwater controls are pivotal activities to ensure their on-going performance as designed. In some cases, if stormwater controls are not adequately operated and maintained they can actually become sources of pollutants reaching our nation's waters. Not putting adequate funding into maintenance may lead to costlier retrofits in the future. Without proper planning, many stormwater controls may fail simultaneously causing local communities to be overwhelmed with infrastructure needs while lacking the funding to make the necessary upgrades.

It was reported that 67% of Phase I and 44% of Phase II programs track construction projects and, in general, they do not distinguish between new and redevelopment projects when tracking. Most MS4s programs review construction site plans for post-construction stormwater water quality and quantity requirements, track/inventory sites, inspect and maintain sites and conduct trainings (Table 4). In general, more Phase I MS4s carry out these activities than Phase IIs.

Table 4. Post construction activities of MS4s

	Phase I	Phase II
Review construction site plans for post-construction stormwater water quality requirements	76%	64%
Review construction site plans for post-construction stormwater water quantity requirements	68%	68%
Tracking/inventory of sites and/or post-construction stormwater management controls on those sites	67%	44%
Inspections of post-construction stormwater management controls	75%	66%
Maintenance of post-construction stormwater management controls	56%	42%
Training of field inspections staff	71%	43%
Contractor training	32%	19%

	Phase I	Phase II
Other	19%	13%
None	7%	13%

Stormwater Controls on Public and Private Property

A large majority of Phase I and Phase II MS4s track, maintain, and inspect stormwater post-construction controls on public property (84% of Phase I MS4s and 68% of Phase II MS4s). However, 6% of Phase I MS4s and 14% of Phase II MS4s report they are not performing these functions.

The majority of MS4s report that they have the authority to inspect stormwater controls on private property but may not have the authority to operate and maintain the controls (Table 5). Only a small percentage of MS4s are maintaining controls installed on private property (7% of Phase I and 5% of Phase II). Most MS4s have the authority to compel private owners to operate and maintain controls on their property. It was reported that 61% of Phase I MS4s and 41% of Phase II MS4s track at least some post-construction controls on private residential and commercial property. It was found that 51% of Phase I and 48% of Phase II communities also inspect them.

Table 5. Inspection authority

	Phase I	Phase II
Yes, MS4 operator has authority to inspect controls on private property	74%	61%
Yes, MS4 operator has authority to operate and maintain controls on private property	22%	19%
Yes, MS4 operator has authority to compel private owners to operate and maintain controls on their private property	73%	64%
No, specify specific barriers or local issues prevent you from having such authority?	10%	13%
Not applicable	8%	13%

A majority of MS4s require private homeowners to maintain controls on their property through an ordinance of other regulatory mechanism (83% of Phase I MS4s and 74% of Phase II MS4s). MS4s require all types of private owners to maintain post-construction controls on their property including homeowners associations, commercial entities, and private institutions (Table 6). Phase I MS4s more frequently have the legal authority to include maintenance obligations or rights of inspection in recorded covenants, deeds, conditions and restrictions or equivalent documents that are binding on privately owned properties than Phase II MS4s (76% and 59%, respectively).

Table 6. Property owners required to maintain controls on their property

	Phase I	Phase II
Private homeowners	61%	58%
Homeowner associations	85%	70%
Homebuilders	50%	48%
Commercial entities	88%	74%
Private institutions	82%	66%
Other	18%	14%
Not applicable	8%	13%

Drivers and Incentives

ICR respondents were asked for information about the main drivers of stormwater retention practices (i.e. low impact development or green infrastructure practices). The three main drivers that were identified include: stormwater management requirements (51% average for both Phase I and Phase II MS4s), flooding (30%), and total maximum daily loads (TMDLs) (21%) as shown in Table 7.

Table 7. Drivers of green infrastructure

	Phase I	Phase II
Stormwater Management Requirement	55%	45%
CSO Long Term Control Plan Requirement	5%	4%
To address flooding	27%	33%
TMDL or other water quality requirement	25%	15%
Safe Drinking Water Act Requirement	4%	7%
Other federal regulation requirement	5%	6%
Other	21%	20%
Unknown	4%	14%
Not applicable	16%	12%

The main local regulatory barriers to stormwater retention practices (e.g. green infrastructure or low impact development) were maximum/minimum roadway widths, requirements setting minimum/maximum cul-de-sac radii, maximum/minimum parking lot size requirements, restrictions on building setbacks/frontages, and curb and gutter requirements (Table 8).

Table 8. Ordinances/regulations preventing retention practice implementation

Response	Phase I	Phase II
Specific Water Requirements		
Standing water restrictions which may prevent the use of extended detention, water reuse or other practices.	41%	17%
Water rights issues which may prevent water harvesting or reuse (rain barrels, cisterns)	12%	5%
Water rights issues which may prevent stormwater infiltration	10%	3%
Restrictions related to groundwater contamination potential	44%	25%
Restrictions related to sole source aquifer limitations	6%	5%
Restrictions on tree/wetland protection requirements	20%	16%
Site Design/Infrastructure Practices		
Curb and gutter requirements which may restrict roadside infiltrations practices	56%	50%
Maximum/minimum parking lot size requirements	55%	56%
Maximum/minimum roadway widths	64%	63%
Requirements setting minimum/maximum cul-de-sac radius	57%	56%
Restrictions on the width of rights-of-way	50%	41%
Setbacks from public or private infrastructure	48%	41%
Conflicts in obtaining private land (e.g., for use as a public right-of-way)	44%	28%

Response	Phase I	Phase II
Building/Structure Requirements		
Restrictions on setbacks/frontages	53%	48%
Restrictions related to plumbing codes (e.g., prohibitions on stormwater reuse for toilet flushing)	46%	23%
Vegetation Requirements		
Restriction on height of vegetation (e.g., wetland vegetation or grasses)	29%	26%
Restriction related to tree placement (e.g., restricting the places where trees may be planted, such as near sidewalks, utility poles, along certain stretches of roads)	47%	33%
Aesthetic requirements for plantings	30%	17%
Other Requirements		
Requirements that may restrict the use of pervious concrete, porous asphalt, modular block pavers, or other alternatives to conventional/impermeable paving materials	31%	13%
Limited mixed use/compact development	16%	14%
Restrictions related to deeds	9%	5%
Restrictions on stormwater reuse for irrigation (e.g., health code restrictions)	22%	6%
Solar access ordinances	4%	2%
Other	16%	6%
No requirements	14%	22%

About half (53%) of all MS4s reported having maintenance concerns that may prevent stormwater retention practices from being implemented in their jurisdiction.

Some MS4s reported that there are categories or areas excluded from stormwater infiltration due to concerns for groundwater contamination or mobilization of contaminated sediments (45% of Phase I MS4s and 19% of Phase II MS4s). In addition, some MS4s reported that there are stormwater discharges from their jurisdiction to a state-defined source water protection area for public water supplies (24% of Phase I MS4s and 20% of Phase II MS4s). About half of MS4s reported having an open space program or natural resource protection area requirement (Table 9), with about a third of Phase I MS4s having requirements for urban growth boundaries, stream restoration, restrictions on impervious surfaces, or incentives for mixed use.

Table 9. Requirements or programs implemented in MS4

Program or Requirement	Phase I	Phase II
Open space program or requirements	68%	51%
Urban growth boundaries	33%	20%
Natural resource area protection	59%	41%
Reduce lot/parcel size requirements	22%	18%
Reduce street width requirements	16%	11%
Stream restoration/remediation program	31%	20%
Incentives for infill/redevelopment	37%	8%
Incentives for Brownfield development	26%	8%

Program or Requirement	Phase I	Phase II
Incentives for mixed use	33%	14%
Enterprise communities or empowerment zones	22%	9%
Buffer/riparian corridor requirements	44%	39%
Restrictions on the amount of impervious surfaces (e.g., caps on the amount of impervious surfaces)	33%	35%
Other	15%	2%
None	8%	19%
Not applicable	3%	4%

Some MS4s have ordinances or other regulatory mechanisms or policies specific to parking lots in their jurisdiction including design standards that require retention practices such as rain gardens or infiltration islands (19% of all MS4s) or design standards that require curb cuts or other flow requirements (16% of all MS4s).

Table 10. Do you have any of the following ordinances or other regulatory mechanisms or policies specific to parking lots in your jurisdiction?

	Phase I	Phase II
Reduced parking lot size requirements	13%	5%
Pervious material requirements	13%	4%
Design standards that require retention practices such as rain gardens, infiltration islands, or others	25%	11%
Design standards that require curb cuts or other flow requirements	17%	15%
Other	26%	13%
No	45%	65%

Incentive measures to promote retention practices in new development and redevelopment are not widely used (approximately 60% of Phase I and Phase II MS4s do not have any incentives) (Table 11). Incentives such as reduced stormwater utility fees, grants, rebates and installation financing, awards and recognition programs, and development incentives are not widely used by Phase I or Phase II communities. For those that do provide incentives, reductions in the volume of stormwater managed (10% for Phase I and 9% for Phase II) and reduced stormwater utility fees (10% for Phase I and 8% for Phase II) were the most common incentives. There was no difference in incentives between new development and redevelopment.

Table 11. Incentives for retention practices in new development

Incentive	Phase I	Phase II
Reduced stormwater utility fees	10%	8%
Development incentives: (e.g., zoning upgrades, expedited permitting, reduced stormwater requirements, increases in floor area ratios, etc.)	8%	4%
Reduction in the volume of stormwater required to be managed	10%	9%
Grants: Provide direct funding to property owners and/or community groups for implementing a range of green infrastructure projects and practices	3%	4%
Rebates & installation financing: (e.g., provide funding, tax credits or reimbursements to property owners who install specific practices)	2%	1%

Incentive	Phase I	Phase II
Awards & recognition programs (e.g., provide marketing opportunities and public outreach for exemplary projects)	6%	4%
Other	8%	3%
None	57%	66%
Unknown	5%	5%
Not Applicable	7%	3%

A large majority of Phase I communities (86%) indicated that they have master plans or similar planning processes that project development over time. A smaller portion of Phase II communities (64%) said that they had these plans or processes in place. MS4s also reported that one of the purposes of their planning process is to direct development toward a specific area, such as infill areas, high density or compact development, brownfield development, and proximity to mass-transit (Table 12).

Table 12. Purpose of planning process to direct development to specific area

Response	Phase I	Phase II
Yes	59%	47%
No	21%	19%
No answer	20%	34%

Incentives Example: The District of Columbia

The District's RiverSmart Homes program offers incentives to homeowners interested in reducing stormwater pollution from their properties (http://ddoe.dc.gov/riversmarthomes). Homeowners receive up to $1,200 to adopt one or more of the following landscape enhancements: Shade Tree Planting, Rain Barrels, Pervious Pavers, Rain Gardens, or BayScaping. After a "stormwater audit" conducted by the District to identify potential landscape enhancements, homeowners contribute a small percentage (about 10%) of the installation costs. The RiverSmart Homes program allows to the District to reduce stormwater discharges on existing residential lots through an incentive-based program.

Retrofits

Retrofitting or the installation or modification of stormwater control measures on sites with existing development (including existing storm sewers) is important in order for the MS4 to enhance the reduction of stormwater pollutants or the discharge volume or flow rates. It was reported that 41% of Phase I and 18% of Phase II MS4s have a stormwater retrofit program. In addition, 60% of Phase I and 39% of Phase II MS4s indicated that they have initiated or completed a retrofit project.

Retrofits are required by 10% of Phase I MS4s and 6% of Phase II MS4s through local ordinance or another legal mechanism. It was reported that the MS4 operator implements retrofits mostly on public property (36% Phase I and 17% Phase II), as compared to private property (9% Phase I and 2% Phase II). However, MS4 operators do promote tree planting on private property (20% Phase I and 6% Phase II). It was reported that stream restoration is part of their retrofit plan for 17% of Phase I MS4s and 8% of Phase II MS4s. Retrofits are mainly paid for by MS4 operators on public property (Table 13).

Table 13. Payments for retrofits

Response	Phase I	Phase II
MS4 operator pays for retrofits only on public property	36%	18%
MS4 operator pays for all retrofits on public and private property	3%	1%
MS4 operator offers grants/incentives for retrofits on private property	10%	5%
Private entities are required to pay for retrofits on their property	21%	8%
Other	9%	3%
Not applicable	6%	8%

Most Phase I MS4s who have retrofit programs indicated that the purpose of the retrofit program was to comply with their stormwater permits (26%), to address flooding (23%), or to address a watershed plan or local concerns (22%) (Table 14). Some Phase II MS4s indicated that flooding (12%) and watershed plan or local concerns (10%) were the primary drivers of their retrofit projects.

Table 14. Purpose of stormwater retrofit program

Response	Phase I	Phase II
To comply with stormwater permit requirements	26%	9%
As a demonstration site or training opportunity	14%	5%
To comply with CSO long term control plan	3%	1%
To address flooding	23%	12%
To address wetlands mitigation	10%	2%
To comply with Total Maximum Daily Load (TMDL) or other Clean Water Act water quality requirement(s)	20%	7%
To comply with Safe Drinking Water Act (SDWA) wellhead protection or UIC regulations	4%	1%
To comply with other federal regulations (ESA, CERCLA, WRDA, etc.)	5%	1%
Other requirements, such as state requirements	4%	1%
To address watershed plan or local water quality, habitat or stream stability or geomorphology concerns	22%	10%
Other	7%	0%
Not applicable	6%	9%

It was reported that at least 7% of Phase I MS4s and 4% of Phase II MS4s provide some type of an incentive for retrofits. The different types of incentives for stormwater retrofits that were reported by MS4s are listed in Table 15.

Table 15. Incentives for stormwater retrofits

Response	Phase I	Phase II
Reduced stormwater utility fees	7%	2%
Development Incentives: (e.g., zoning upgrades, expedited permitting, reduced stormwater requirements, increases in floor area ratios, etc)	1%	0%
Grants: Provide direct funding to property owners and/or community groups for implementing a range of green infrastructure projects and practices	6%	3%

Response	Phase I	Phase II
Rebates & Installation Financing: (e.g., provide funding, tax credits or reimbursements to property owners who install specific practices)	4%	0%
Awards & Recognition Programs (e.g., provide marketing opportunities and public outreach for exemplary projects)	2%	2%
Technical or resource assistance	8%	2%
Other	3%	0%
None	20%	15%
Not applicable	9%	9%

Public Education and Outreach

EPA regulations require MS4s to develop a public education program to inform the public about the impacts of stormwater discharges and steps they can take to reduce pollutants in stormwater runoff. Phase I and Phase II MS4s largely implement the same types of activities to meet the public education and outreach component of their stormwater programs. Brochures, fact sheets, storm drain labeling, event participation, and educational programs are the most frequently utilized activities. Activities like contractor training are less utilized (61% for Phase I and 34% for Phase II). Phase I MS4s are more likely to utilize television advertisements or stormwater hotlines. A higher percentage of Phase I MS4s utilize radio features, television advertisements/programs, contractor training, stormwater hotlines, direct mail, surveys, tributary/watershed/floodway signage, and car washing public program compared to Phase II MS4s. These results may be a function of the size of the communities and the maturity of the programs since Phase I programs have had more time to shape their programs than Phase II programs (Table 16).

Table 16. Public education and outreach activity

	Phase I	Phase II
Brochures, fact sheets, guides, or similar documents	96%	90%
Radio features	44%	22%
Television advertisements or programs	56%	32%
Educational programs (for the general public, school children, teachers, etc.)	85%	67%
Event participation (conference participation, earth day events, fairs, etc.)	90%	73%
Staff training	93%	80%
Contractor training	61%	34%
Storm drain labeling (stenciling or marking)	86%	65%
Stormwater hotlines	69%	35%
Direct mail	57%	45%
Surveys	52%	23%
Tributary signage	27%	16%
Watershed or floodway signage	31%	14%
Website	82%	77%
Car washing public program	25%	9%
Other	28%	19%
None	2%	4%

Public Education & Pollution Prevention Example: Birmingham, Alabama Annual Report

As an accredited affiliate of the Keep America Beautiful program, Birmingham noticed that there was a lot of cigarette litter within a section of the city. They decided to place cigarette butt receptacles at key places and then tracked how much litter was reduced. After the first week of the cigarette butt receptacle placement, the Keep Birmingham Beautiful Commission reported a 40% reduction of cigarette litter within the project area. The city reported in this achievement in their annual report.

In addition, through the Keep America Beautiful program, they calculate a litter index, which through visual and written scoring enables the city to evaluate the amount of litter in selected community areas. They reported that determining this litter index helps build consensus on priority problem areas and provides a useful measurement to determine the effectiveness of their litter education program over time. The City plans to track this litter index each year and compare it with the index of the previous years.
http://www.informationbirmingham.com/pdf/Storm%20Water/2009%20Annual%20Report.pdf

Public Involvement

EPA regulations require MS4s to provide the public with opportunities to review and comment on the stormwater management program, at a minimum, in accordance with State, Tribal and local public notice requirements. Both Phase I and Phase II MS4s use public meetings/citizen panels (67% for both) as part of their stormwater public involvement program. However, storm drain labeling (74% for Phase I and 57% for Phase II) and community clean-ups (80% for Phase I and 64% for Phase II) are more common in Phase I MS4s than Phase II MS4s. Adopt-a-storm drain and citizen watch groups were used less often with responses between 5% and 14%.

The questionnaire responses indicate that many MS4s tend to address requirements for public education and outreach simultaneously with those for public involvement. It is evident that most people perceive these two elements to go hand and hand. For example, many indicated the same activities when answering questions about these two minimum control measures.

Illicit Discharge Detection and Elimination

EPA regulations require MS4s to implement an illicit discharge detection and elimination program that includes mapping, ordinances, an illicit discharge plan, and education. Most MS4s indicated that they did have storm sewer system mapping (83% of Phase I and 77% of Phase II communities). A little over half of respondents (55%) indicated that they have databases or paper tracking/inventories of outfalls. It was reported that 37% of MS4s have less than 100 outfalls in their MS4 service area. There were 19% of MS4s that reported they had 101 – 500 outfalls in their MS4s service area (it should be noted that 28% respondents reported that the number of outfalls were unknown). MS4s that perform outfall inspections were roughly equal for Phase I and Phase II communities with 75% and 72%, respectively. However, less than 50% of Phase II MS4s have a public reporting method (e.g. hotline), while 78% of Phase I MS4s do.

Pollution Prevention/Good Housekeeping for Municipal Operations

EPA Phase II regulations require MS4s to develop and operation and maintenance program for municipal operations. The majority of MS4s are implementing a variety of practices to address pollution

prevention for their own municipal operations, including an inventory of municipal facilities, municipal facility assessments and inspections, storm sewer system maintenance, street sweeping, and field staff training. Phase I MS4s are more likely to have controls for outdoor vehicle fueling/washing and pesticide/herbicide/fertilizer management. Additionally, Phase I MS4s are more likely to conduct contractor pollution prevention training (47%) than Phase II MS4s (17%).

Some municipalities have an ordinance or other regulatory mechanisms that prohibit or limit the sale and usage of fertilizers, detergents and pesticides (Table 17). Communities that do prohibit/restrict these materials, apply these restrictions to residential, commercial, and municipal/public areas generally equally.

Table 17. Fertilizer, detergent and pesticide limits on sale and usage.

	Number of Phase I MS4s	Number of Phase II MS4s
Nitrogen Fertilizer		
Prohibit sale	2	0
Prohibit usage	5	3
Limit usage	19	7
Phosphorus Fertilizer		
Prohibit sale	3	6
Prohibit usage	11	13
Limit usage	22	8
Phosphorus Detergent		
Prohibit sale	9	5
Prohibit usage	2	5
Limit usage	13	3
Pesticides		
Prohibit sale	8	1
Prohibit usage	10	2
Limit usage	14	7

Construction

Similar to post-construction, EPA regulations require MS4s to develop a program to address discharges from construction sites disturbing at least one acre. Both Phase I and II MS4s review site plans for construction (94% and 93% total) and have site inspection programs (92% and 83%). Most Phase I MS4s also train their field staff (87%), respond to complaints (93%), and take enforcement actions (86%). Phase II MS4s complete these activities as well, although the frequency is lower for field staff training (58%) and enforcement (64%).

Industrial

EPA regulations require Phase I MS4s to address stormwater runoff from industrial facilities, but a similar requirement does not exist for Phase II MS4s. Both Phase I and II MS4s are carrying out industrial program activities including inventorying industrial facilities, performing site inspections of industrial and commercial facilities, and training inspectors (Table 17). For example, approximately 73% of Phase I MS4s inventory industrial facilities and conduct inspections.

Table 18. Industrial activities

Activity	Phase I	Phase II
Inventory of industrial facilities	73%	9%
Education of industrial operators about stormwater requirements and/or controls	59%	6%
Site inspection of industrial facilities	73%	14%
Site inspection of commercial facilities	69%	16%
Training of inspectors	69%	10%
Other	16%	11%
None	12%	66%

Monitoring

Phase I MS4s are required to monitor and characterize their stormwater discharges, but Phase II MS4s do not have a specific requirement to conduct water quality monitoring. Forty-nine percent of Phase I MS4s indicated that permits require them to perform some sort of outfall monitoring other than visual inspections under the Illicit Discharge Detection and Elimination program while only 20% of Phase II MS4s conduct outfall monitoring. Most MS4s do not conduct monitoring for pollutant levels or flow-related parameters. However, 52% of Phase I MS4s and 33% of Phase II MS4s perform dry weather screening of stormwater outfalls and 64% of Phase I MS4s and 20% of Phase II MS4s conduct in-stream monitoring for water quality parameters.

Almost half of Phase I MS4s (45%) conduct in-stream monitoring for biological parameters, but only 13% of Phase II MS4s conduct biological monitoring.

Monitoring Example: Puget Sound Stormwater Work Group

The Stormwater Work Group (SWG) (http://www.ecy.wa.gov/programs/wq/psmonitoring/swworkgroup.html) is a coalition of federal; tribal; state and local governments; business; environmental; agriculture; and research interests that was convened at the request of the Puget Sound Partnership and Department of Ecology to develop a Stormwater Monitoring and Assessment Strategy for the Puget Sound Region. The strategy is intended to provide a coordinated, integrated approach to quantifying the stormwater problem in Puget Sound and to help efficiently and effectively manage stormwater to reduce harm to the ecosystem. The Strategy describes both the *scientific framework* for the stormwater-related monitoring and assessment that will be implemented: what decisions were needed and were made about priorities for data collection, what information needs to be collected, and what analyses need to be conducted; as well as an implementation plan for conducting the monitoring and assessment activities: who will collect what data when, where, and how; what methods, protocols, and data reporting standards will they adhere to; and how the collective capacity and resources of the region will be brought together to provide the regional understanding of stormwater impacts and efficacy of management actions that is needed to recover Puget Sound and the waters that feed it.

SUMMARY AND CONCLUSIONS

The information collection request of 471 regulated MS4s is a comprehensive national data collection on the implementation of the municipal stormwater program. The results of this questionnaire present a unique summary of how MS4s nationwide are implementing EPA's municipal stormwater program requirements. Many states have strengthened their MS4 programs to better protect water quality by advancing both where the program is applied and by adding specificity to stormwater program elements to improve implementation.

Some of highlights include:

- Spatial Extent: 61% of Phase II MS4s have their entire jurisdiction covered by the stormwater program. In addition, 14 states require MS4s to implement the stormwater program jurisdiction-wide if only a portion of their jurisdiction is in the urbanized area.

- Post-construction Program: most Phase I MS4s (80%) and Phase II MS4s (64%) implement a post-construction standard that includes either numeric or specific stormwater performance standards or design criteria for stormwater controls.

- There are high rates of implementation for many of the key activities such as public education and involvement, storm sewer system mapping and outfall inspections, and municipal maintenance.

- Many MS4s are implementing retrofit programs (41% of Phase I MS4s and 18% of Phase II MS4s). These programs are important to enhance the reduction of stormwater pollutants and discharge volume and rates of stormwater to receiving waters.

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